FIG. 1

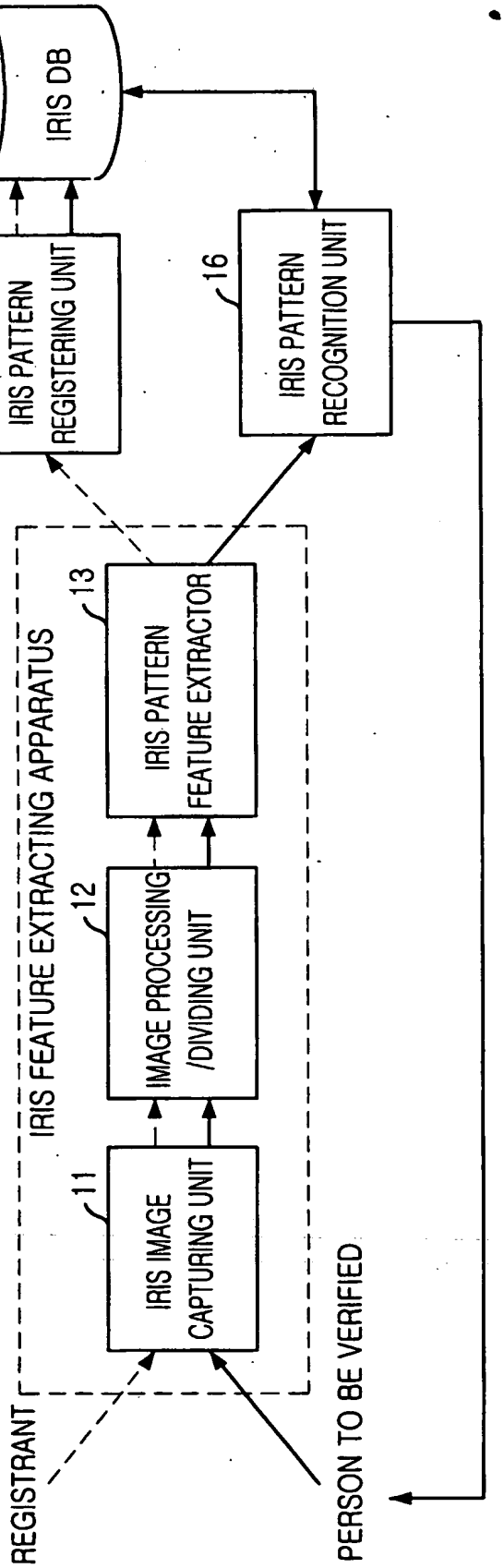

15
IRIS DB
14
IRIS PATTERN REGISTERING UNIT
16
IRIS PATTERN RECOGNITION UNIT
IRIS FEATURE EXTRACTING APPARATUS
13
IRIS PATTERN FEATURE EXTRACTOR
12
IMAGE PROCESSING /DIVIDING UNIT
11
IRIS IMAGE CAPTURING UNIT
REGISTRANT
PERSON TO BE VERIFIED

FIG. 2

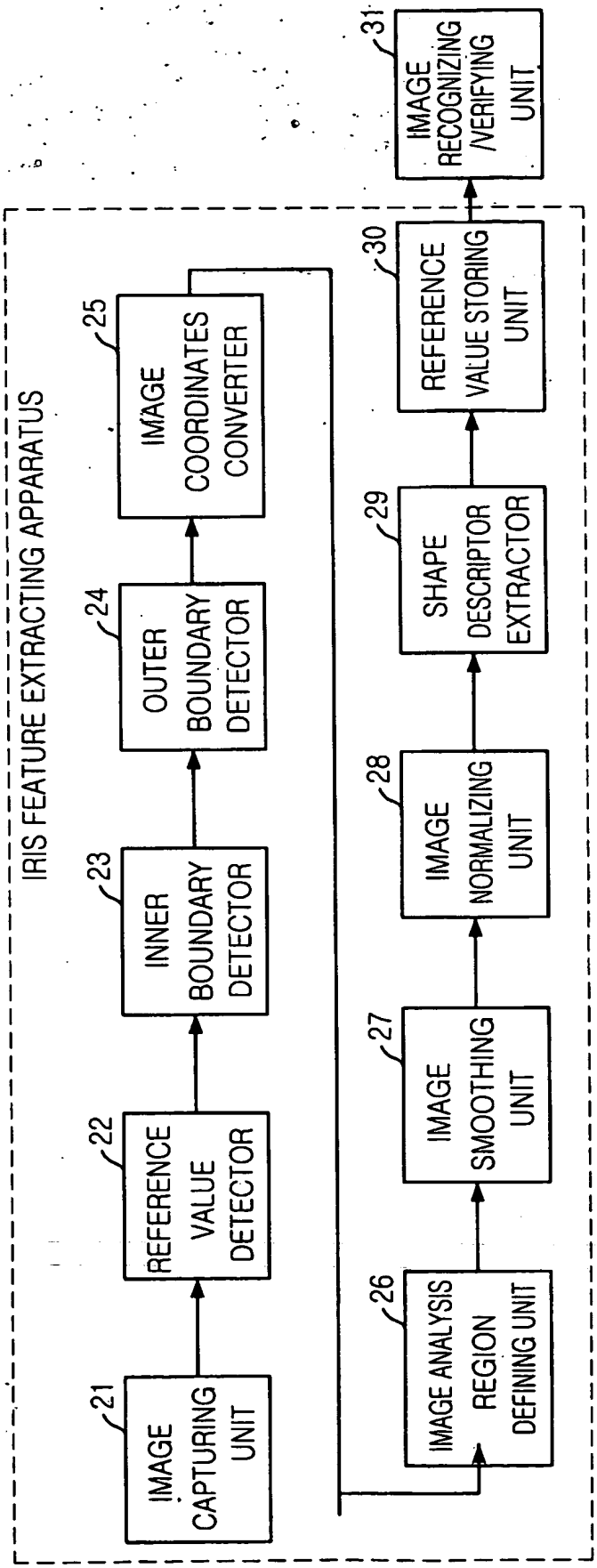

IRIS FEATURE EXTRACTING APPARATUS
21
IMAGE CAPTURING UNIT
22
REFERENCE VALUE DETECTOR
23
INNER BOUNDARY DETECTOR
24
OUTER BOUNDARY DETECTOR
25
IMAGE COORDINATES CONVERTER
26
IMAGE ANALYSIS REGION DEFINING UNIT
27
IMAGE SMOOTHING UNIT
28
IMAGE NORMALIZING UNIT
29
SHAPE DESCRIPTOR EXTRACTOR
30
REFERENCE VALUE STORING UNIT
31
IMAGE RECOGNIZING /VERIFYING UNIT

FIG. 3

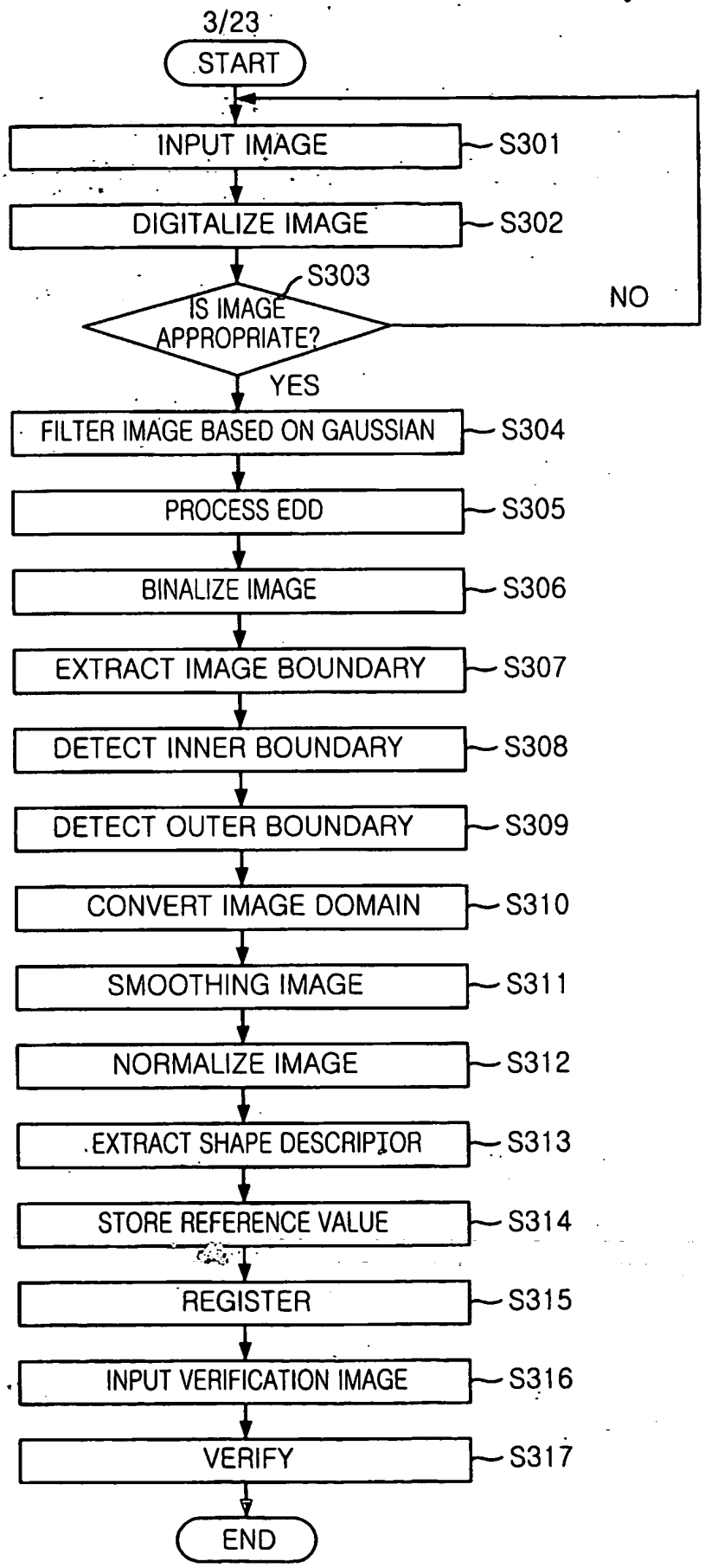

START
INPUT IMAGE
S301
DIGITALIZE IMAGE
S302
S303
IS IMAGE APPROPRIATE?
NO
YES
FILTER IMAGE BASED ON GAUSSIAN
S304
PROCESS EDD
S305
BINALIZE IMAGE
S306
EXTRACT IMAGE BOUNDARY
S307
DETECT INNER BOUNDARY
S308
DETECT OUTER BOUNDARY
S309
CONVERT IMAGE DOMAIN
S310
SMOOTHING IMAGE
S311
NORMALIZE IMAGE
S312
EXTRACT SHAPE DESCRIPTOR
S313
STORE REFERENCE VALUE
S314
REGISTER
S315
INPUT VERIFICATION IMAGE
S316
VERIFY
S317
END

FIG. 4

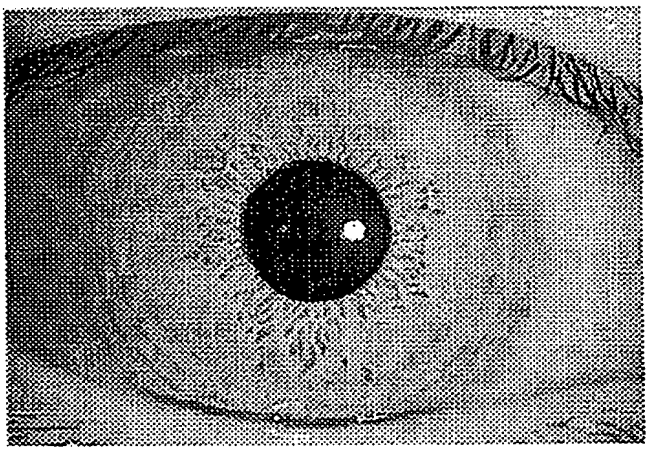
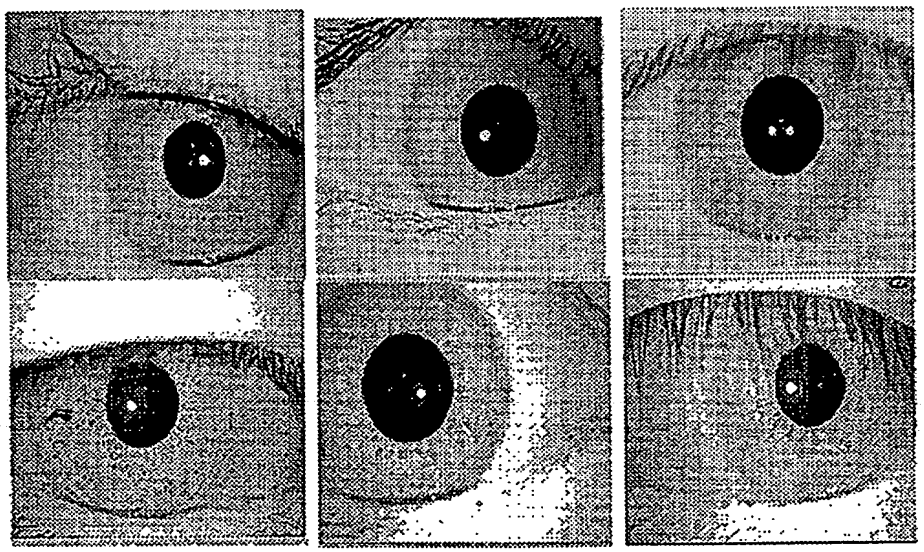


FIG. 5



(a) (b) (c)

FIG. 6

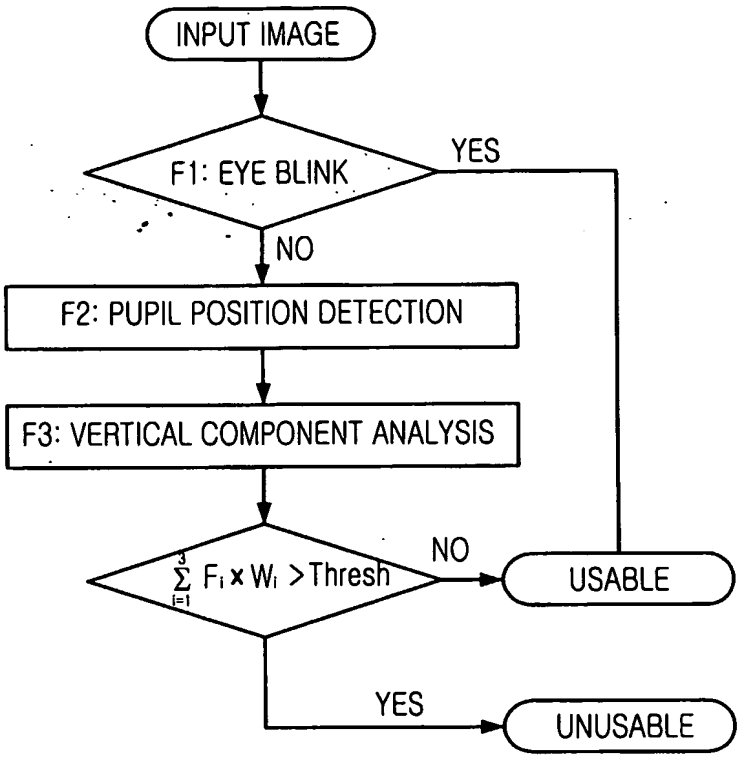

INPUT IMAGE
F1: EYE BLINK
YES
NO
F2: PUPIL POSITION DETECTION
F3: VERTICAL COMPONENT ANALYSIS
$\sum_{i=1}^{3} F_i \times W_i > Thresh$
NO
USABLE
YES
UNUSABLE

FIG. 7

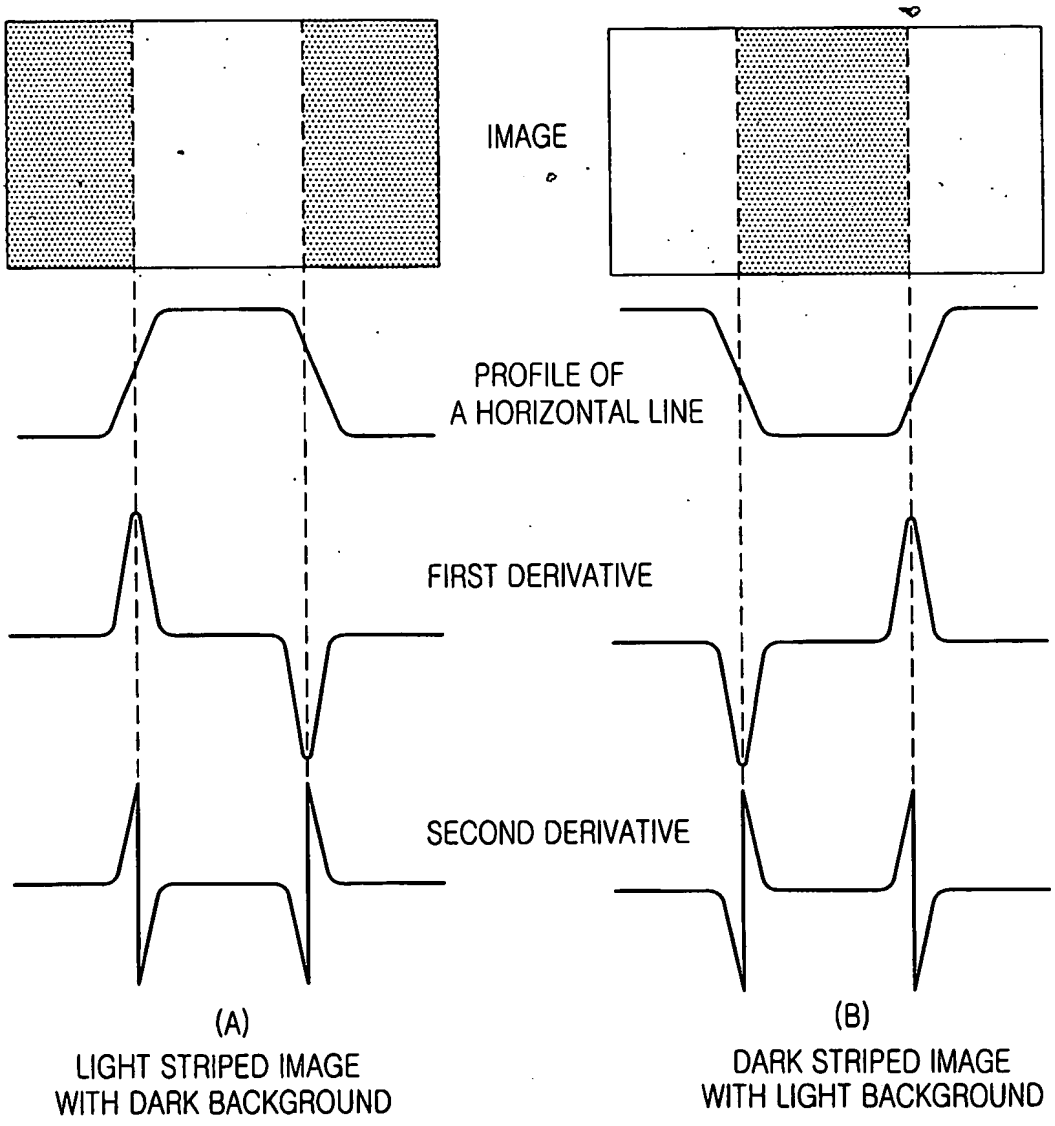
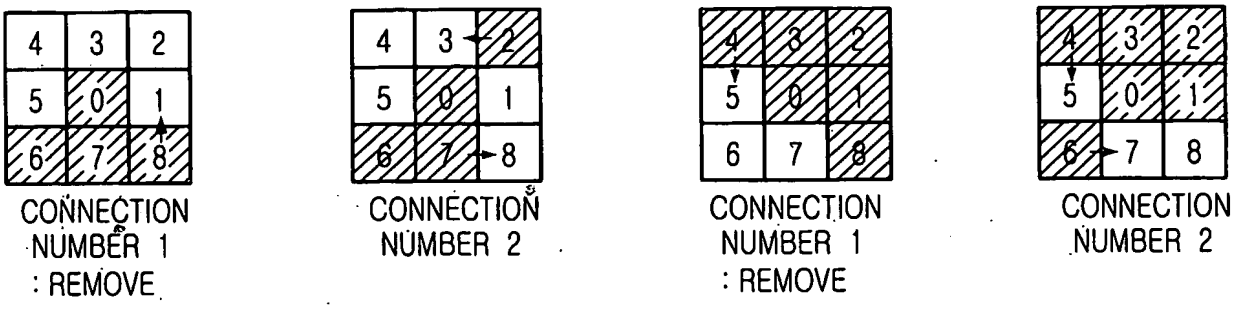


IMAGE
PROFILE OF
A HORIZONTAL LINE
FIRST DERIVATIVE
SECOND DERIVATIVE
(A)
LIGHT STRIPED IMAGE
WITH DARK BACKGROUND
(B)
DARK STRIPED IMAGE
WITH LIGHT BACKGROUND

FIG. 8



CONNECTION NUMBER :
MINIMUM : 0, MAXIMUM : 4

FIG. 9

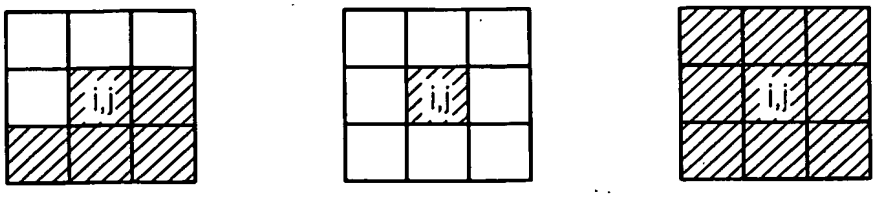


FIG. 10

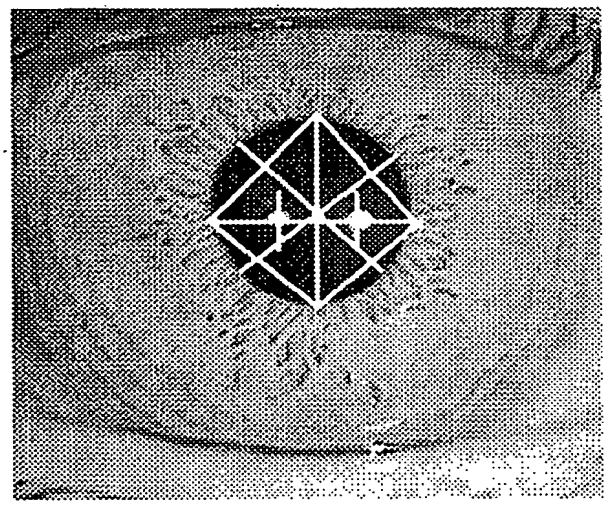


FIG. 11

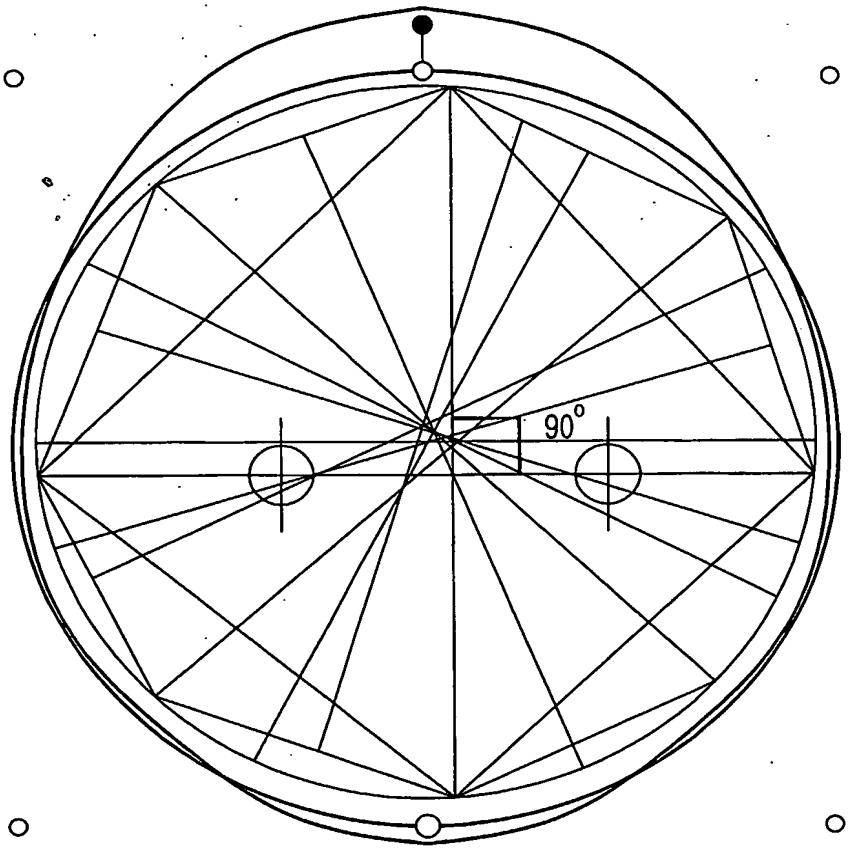
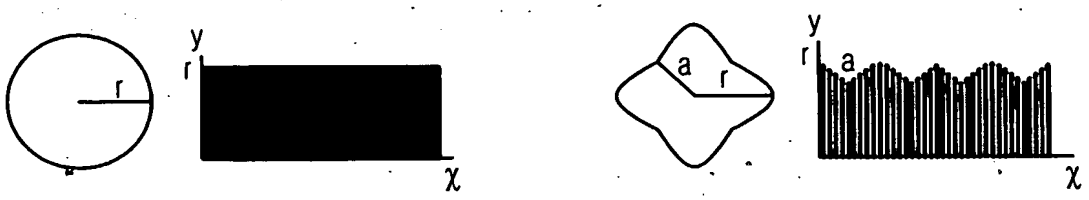


FIG. 12



(a) CIRCLE IMAGE (b) STAR-SHAPED IMAGE

FIG. 13

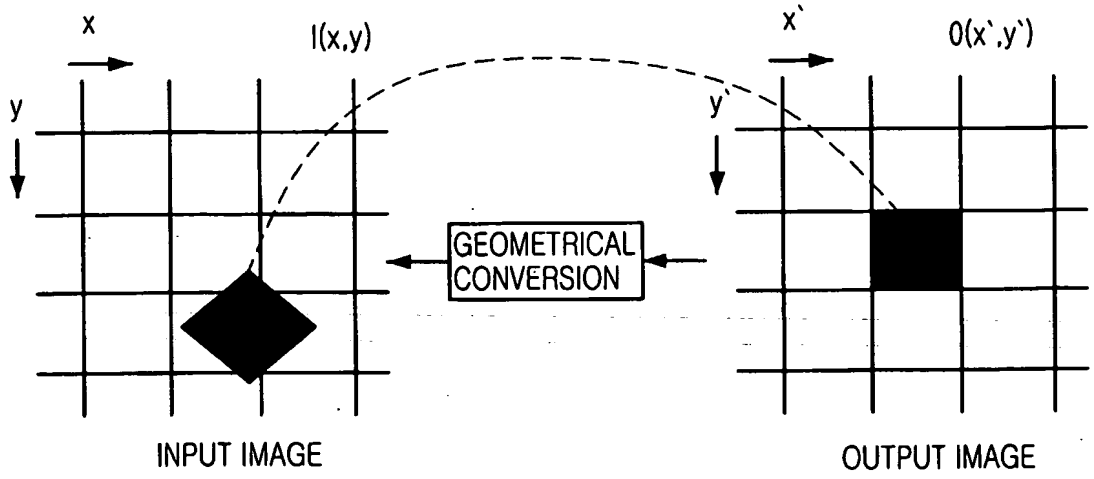
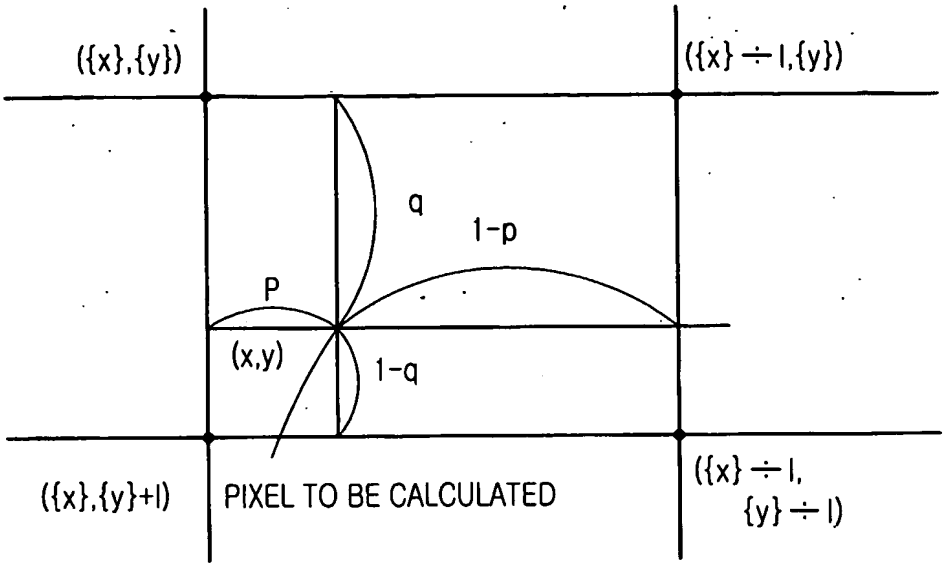


FIG. 14



{x} AND {y} ARE INTEGERS THAT IS X, Y AND BELOW

FIG. 15

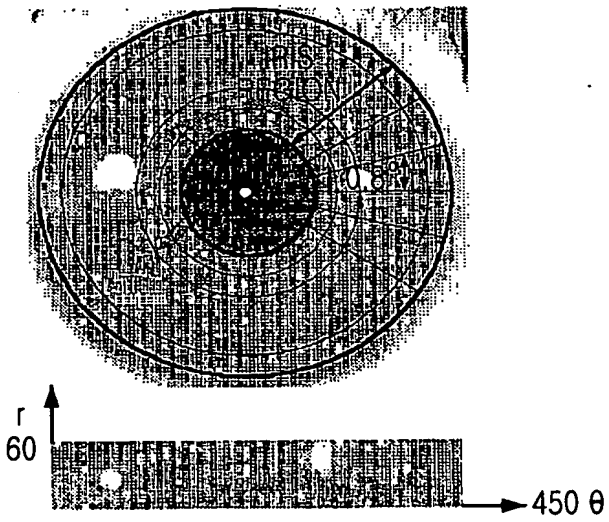


FIG. 16

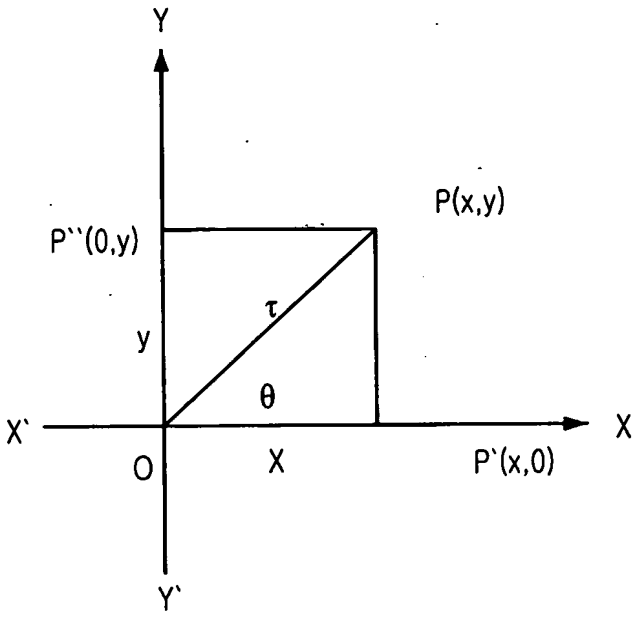


FIG. 17

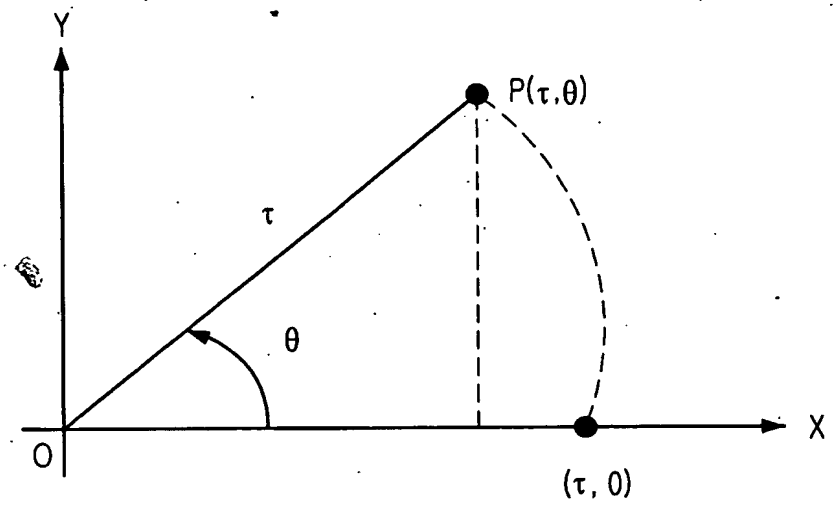


FIG. 18

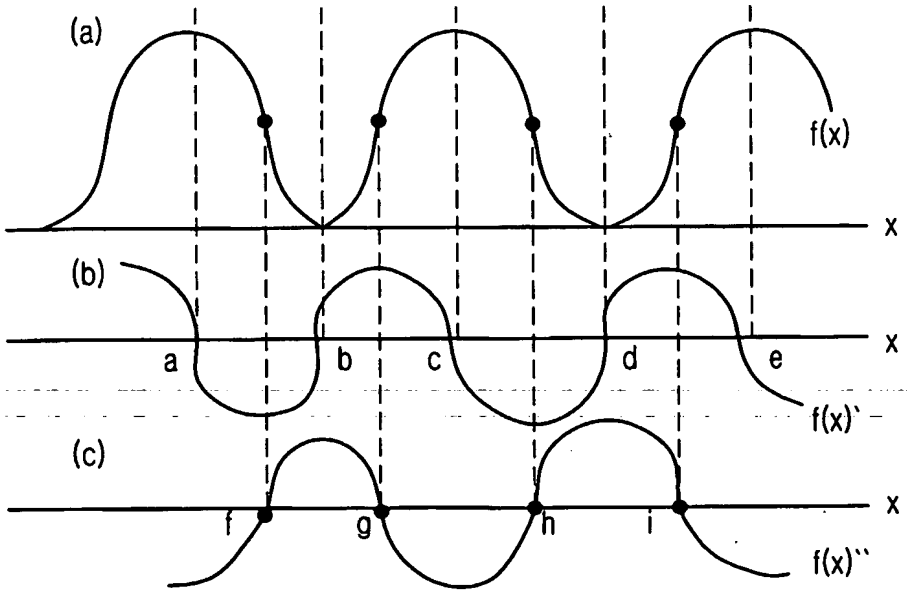


FIG. 19

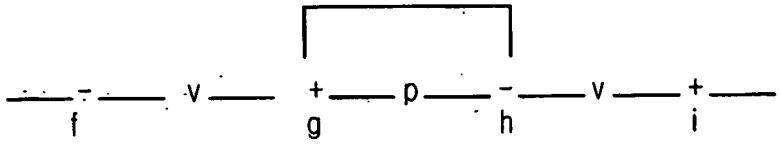


FIG. 20

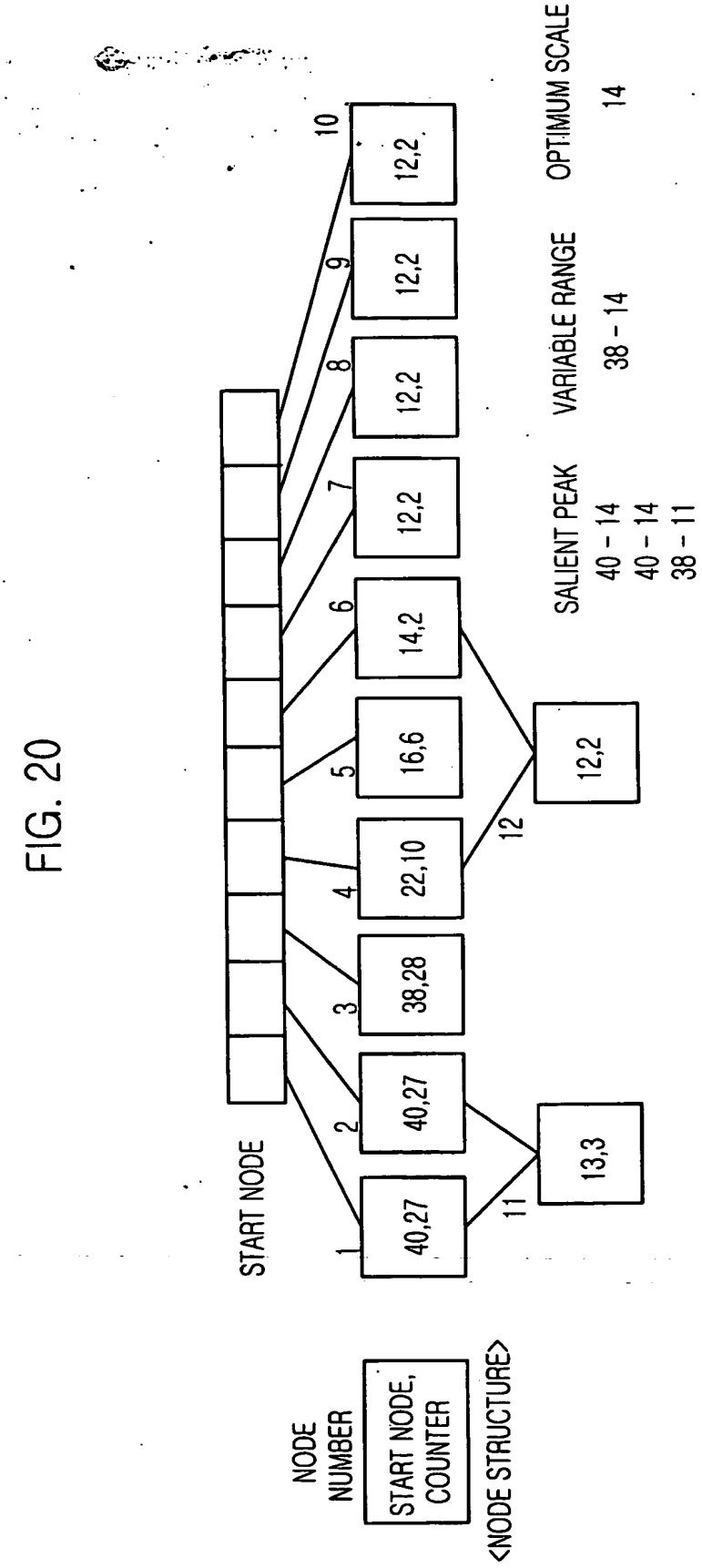

NODE NUMBER
START NODE, COUNTER
<NODE STRUCTURE>
START NODE
1
2
3
4
5
6
7
8
9
10
11
12
40,27
40,27
38,28
22,10
16,6
14,2
12,2
12,2
12,2
12,2
13,3
12,2
SALIENT PEAK
40 - 14
40 - 14
38 - 11
VARIABLE RANGE
38 - 14
OPTIMUM SCALE
14

FIG. 21

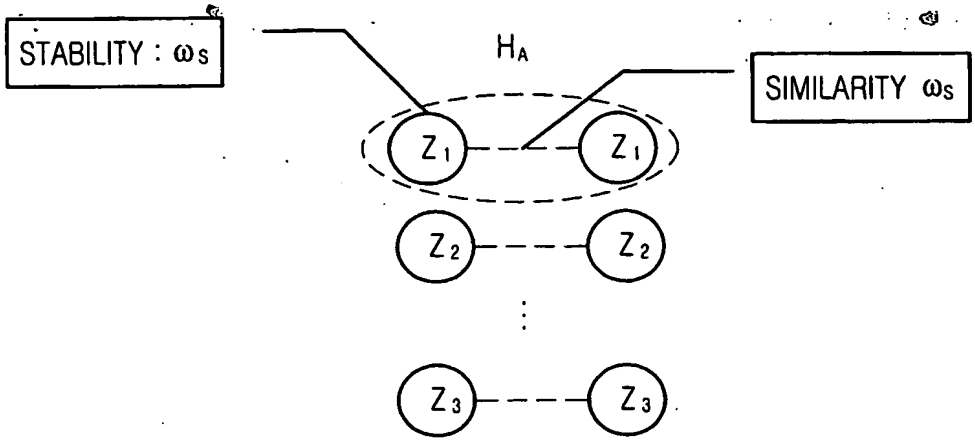


FIG. 22

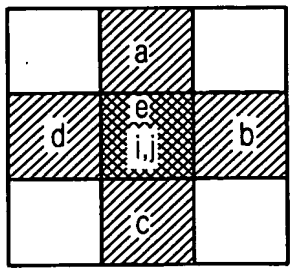


FIG. 23

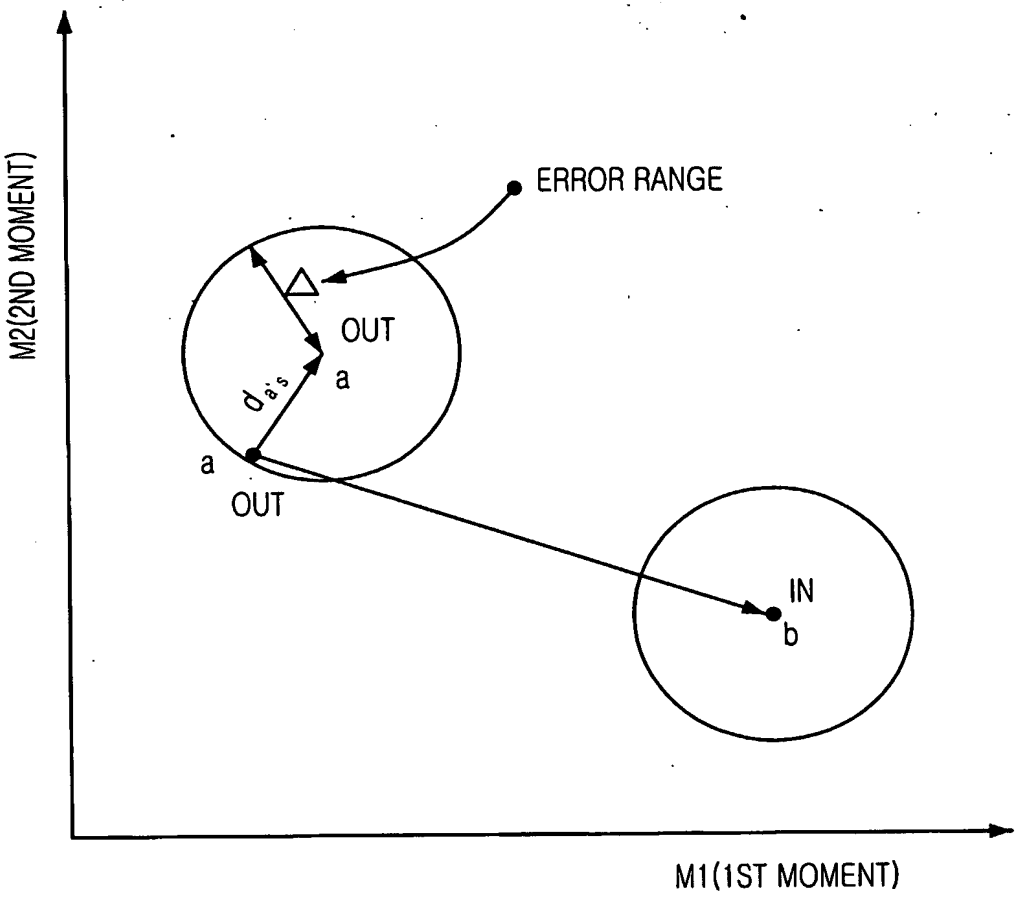
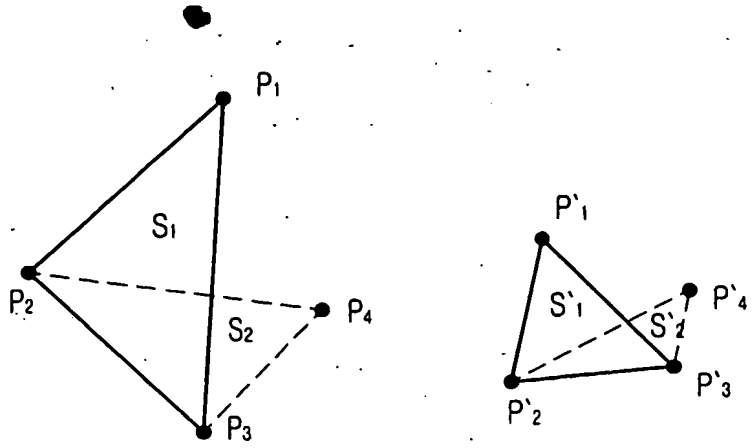


FIG. 24



(a) LOCAL FEATURE OF MODEL IMAGE

(b)LOCAL FEATURE OF INPUT IMAGE

FIG. 25

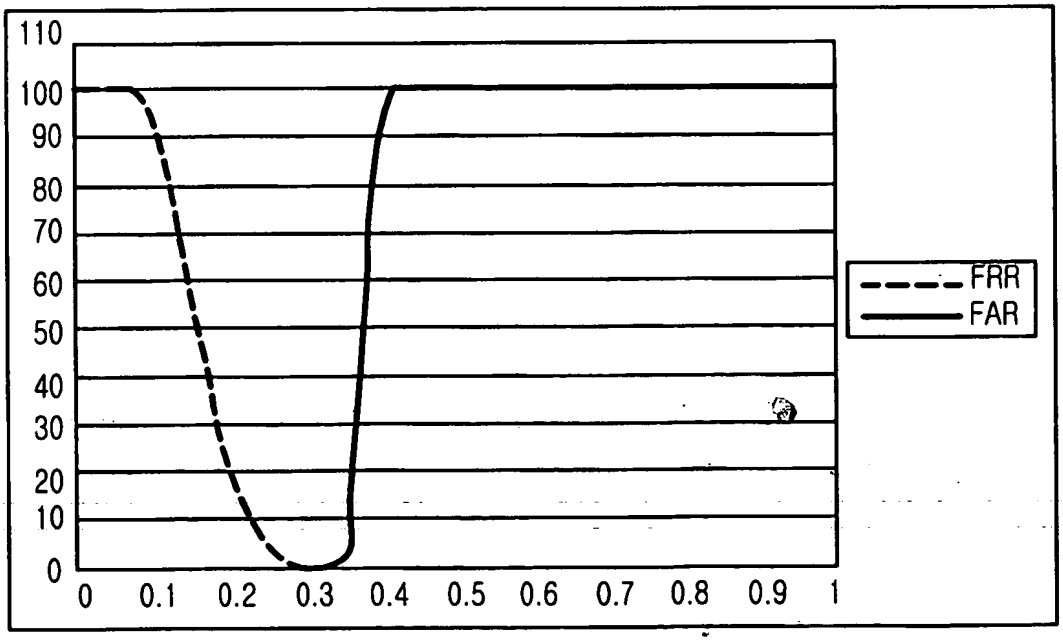


FIG. 26

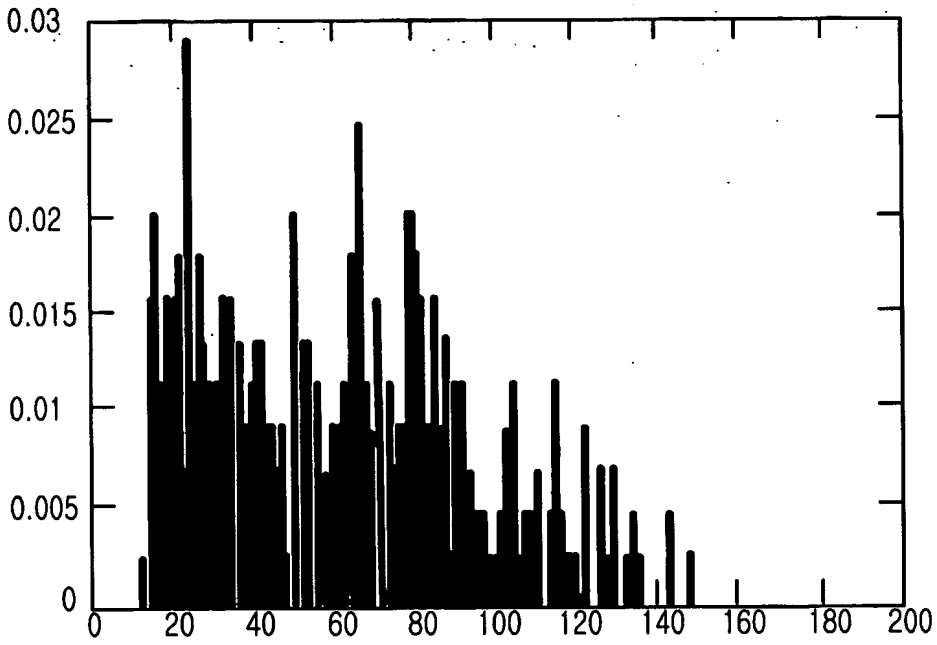


FIG. 27

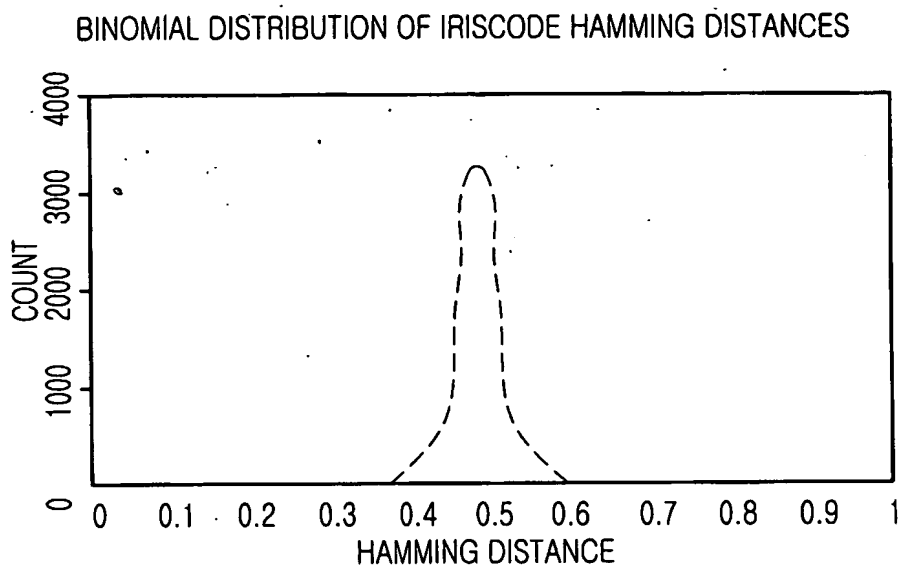

BINOMIAL DISTRIBUTION OF IRISCODE HAMMING DISTANCES
COUNT
0
1000
2000
3000
4000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
HAMMING DISTANCE

FIG. 28

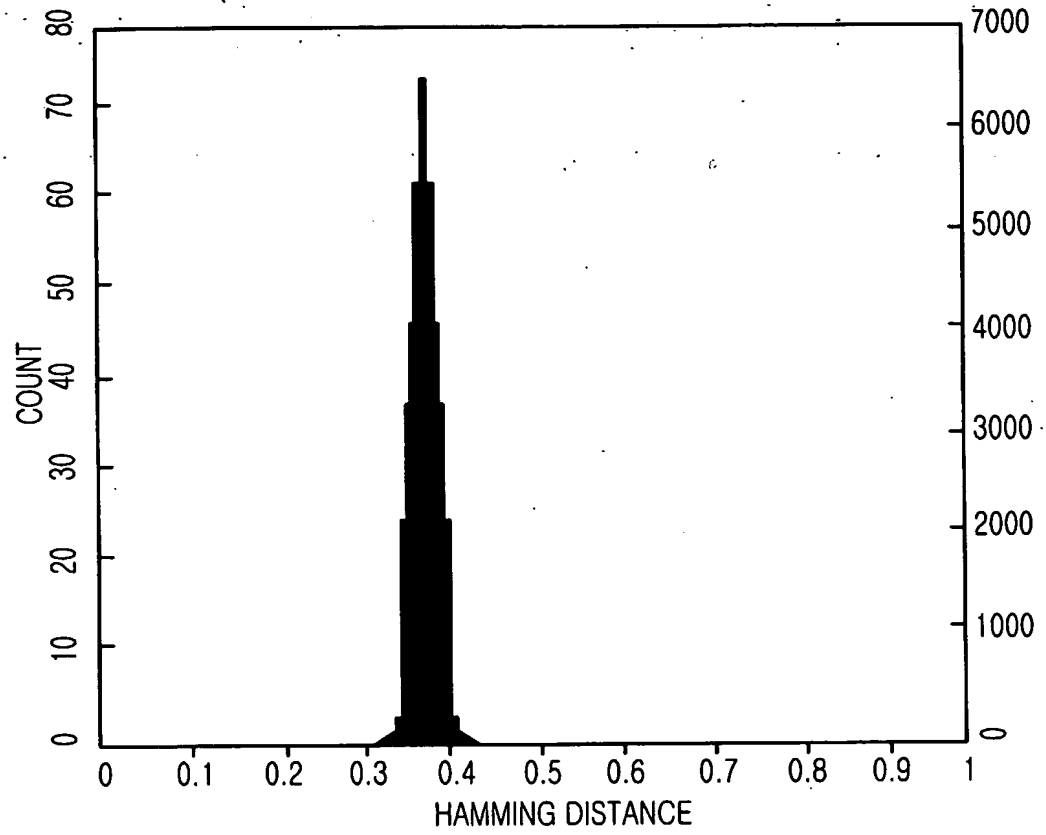
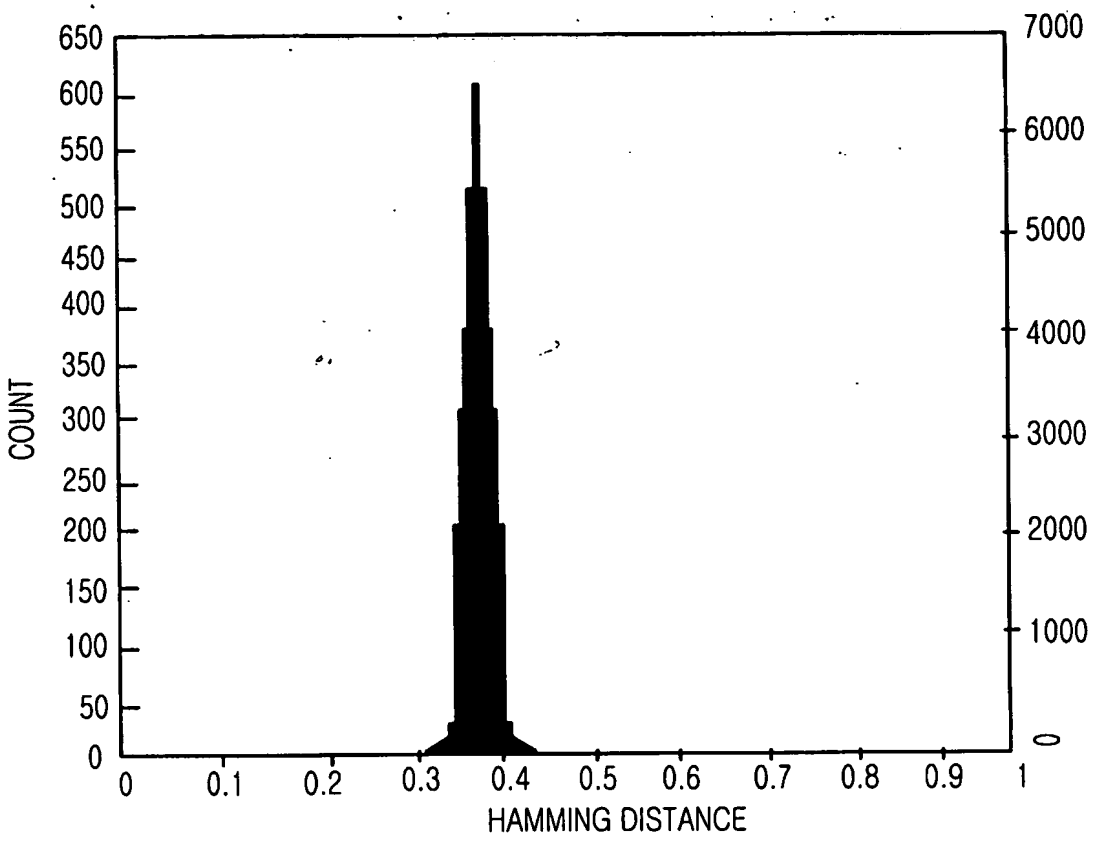

COUNT
0
10
20
30
40
50
60
70
80
7000
6000
5000
4000
3000
2000
1000
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
HAMMING DISTANCE

FIG. 29


650
600
550
500
450
400
350
300
250
200
150
100
50
0
COUNT
7000
6000
5000
4000
3000
2000
1000
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
HAMMING DISTANCE